

TFT LCD Tentative Specification

MODEL NO.: V260B1 - L02

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

V260B1- L02 is a 26" TFT Liquid Crystal Display module with 4U-CCFL Backlight unit and RSDS interface.

This module supports 1366 x 768 WXGA format and can display 16.2M colors (6-bits+FRC colors).

1.2 FEATURES

- Excellent brightness (400nits)
- Contrast ratio 800:1
- Fast response time (8ms)
- Color saturation NTSC 72%
- Viewing angle: 160(H)/150(V) (CR>10) TN technology
- RSDS (Reduced Swing Differential Signaling) interface
- Color reproduction (Nature color)
- RoHS compliance

1.3 APPLICATION

- TFT LCD TVs
- Multi-Media Display

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	575.769 (H) x 323.712 (V) (26" diagonal)	mm	(1)
Bezel Opening Area	580.8 (H) x 328.8 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1366 x R.G.B. x 768	pixel	
Pixel Pitch (Sub Pixel)	0.1405 (H) x 0.4215 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.2M	color	
Display Operation Mode	Transmissive mode / Normally White	-	
Surface Treatment	Anti-Glare coating (Haze 25%) Hard coating (3H)	-	

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	625	626	627	mm (1)
	Vertical(V)	372	373	374	mm (1)
	Depth(D)	41.5	42.5	43.5	mm
Weight	4200	4700	5200	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	(+50)	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

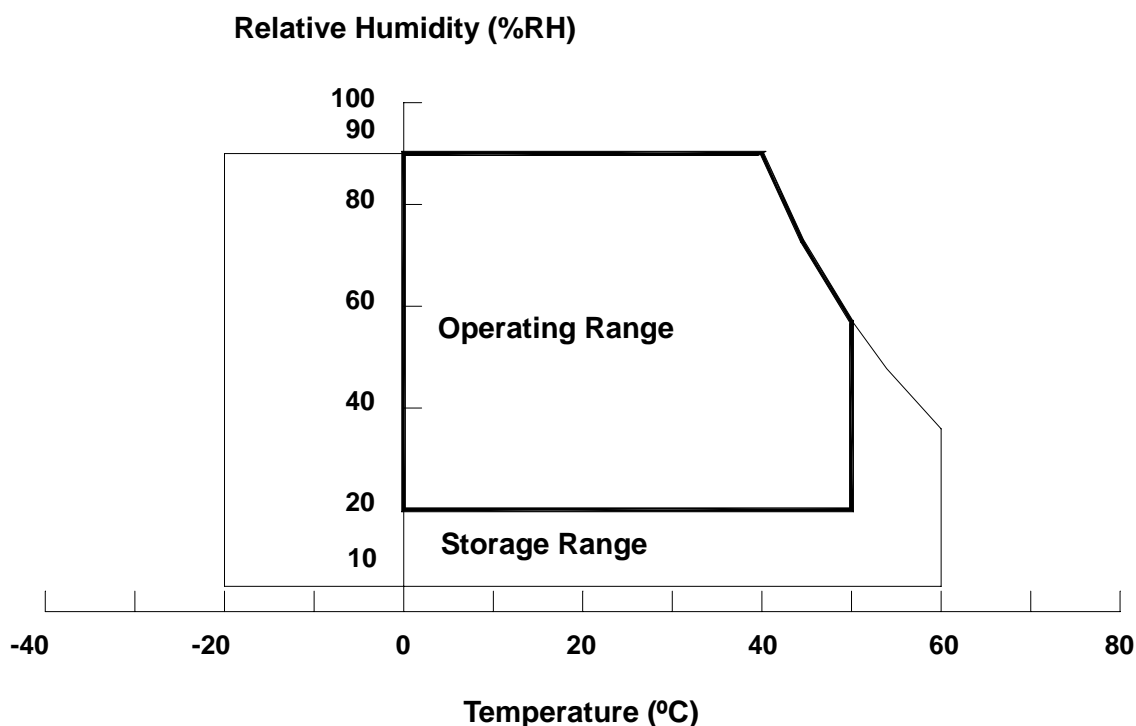
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	VIN5	4.5	5.5	V	(1)
Logic Input Voltage	VDD	-0.3	3.6	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

2.3.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _W	-	3000	V _{RMS}	
Power Supply Voltage	V _{RI}	0	30	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VIN5	4.5	5.0	5.5	V	
		VDD	3.1	3.3	3.5	V	
Power Supply Current		I5V	-	1000	-	mA	
		I3.3V	-	50	-	mA	
CMOS interface	Input High Threshold Voltage	V _{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V _{IL}	0	-	0.7	V	

3.2 RSDS CHARACTERISTICS

Ta = -10~+85 °C

Item	Symbol	Condition	Value			Unit
			Min	Typ	Max	
RSDS high input Voltage	V _{DIFFRSDS}	V _{CMRSDS} = +1.2 V (1)	100	200	-	mV
RSDS low input Voltage	V _{DIFFRSDS}	V _{CMRSDS} = +1.2 V (1)	-	-200	-100	mV
RSDS common mode input voltage range	V _{CMRSDS}	V _{DIFFRSDS} = 200mV (2)	VSSD+0.1	Note(3)	VSSD+1.2	V
RSDS Input leakage current	I _{DL}	D _{xx} P, D _{xx} N, CLK0, CLPN	-10	-	10	μA

 Note (1) $V_{CMRSDS} = (V_{CLKP} + V_{CLKN})/2$ or $V_{CMRSDS} = (V_{DxxP} + V_{DxxN})/2$

 Note (2) $V_{DIFFRSDS} = V_{CLKP} - V_{CLKN}$ or $V_{DIFFRSDS} = V_{DxxP} - V_{DxxN}$

 Note (3) $V_{CMRSDS} = 1.2V(V_{DDD} = 3.3V)$

3.3 BACKLIGHT INVERTER UNIT

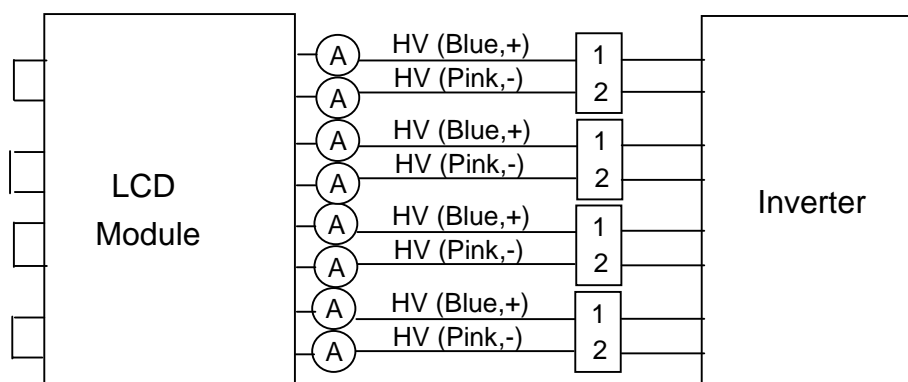
3.3.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	V _W	-	1920	-	V _{RMS}	I _L = 7.5mA
Lamp Current(HI-Side)	I _L	7	7.5	8	mA _{RMS}	(1)
Lamp Starting Voltage	V _s	-	-	3180	V _{RMS}	(2), Ta = 0 °C
		-	-	2650	V _{RMS}	(2), Ta = 25 °C
Operating Frequency	F _O	40	-	80	KHz	(3)
Lamp Life Time	L _{BL}	50,000	-	-	Hrs	(4)

3.3.2 CMO INVERTER JIG CHARACTERISTICS (Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Consumption	P _{BL}	-	54	56	W	(5),(6), I _L = 7.5mA
Input Voltage	V _{BL}	22.8	24	25.2	V _{DC}	
Input Current	I _{BL}	-		-	A	Non Dimming
Input Ripple Noise	-	-	-	500	mV _{P-P}	V _{BL} =22.8V
Backlight Turn on Voltage	V _{BS}	(3180)	-	-	V _{RMS}	Ta = 0 °C
		(2650)	-	-	V _{RMS}	Ta = 25 °C
Oscillating Frequency	F _W	55	58	61	kHz	
Dimming frequency	F _B	150	160	170	Hz	
Minimum Duty Ratio	D _{MIN}	-	20	-	%	

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



Note (2) The lamp starting voltage V_S should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp could not be lighted on completed.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

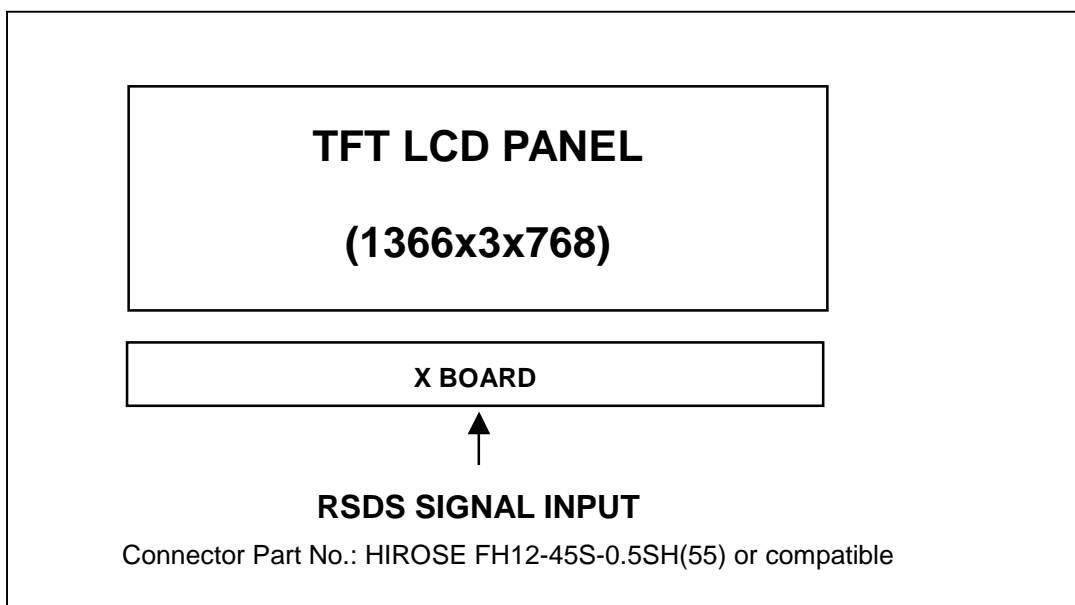
Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at Ta = 25 ± 2 and I_L = 7.0 ~ 8.0 mA_{RMS}.

Note (5) The power supply capacity should be higher than the total inverter power consumption P_{BL}. Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when inverter dimming.

Note (6) To enhance the performance of backlight, the power consumption will increase to 1.5 times of the typical power consumption P_{BL} in the power on stage and 20 seconds later it will return to typical value. Thus, the power source capacity for inverter should be considered to supply the initial power consumption at power on duration.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. PIN CONNECTION

5.1 TFT LCD MODULE

Pin assignment

CN2(X) Connector Pin Assignment

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	GND	Ground	29	TP1	RSDS data latch
2	NC	No connection	30	POL	polarity invert
3	NC	No connection	31	GND	Ground
4	GND	Ground	32	NC	No connection
5	B2P	RSDS data signal (Blue2)	33	VDD	Logic Power supply: +3.3V
6	B2N	RSDS data signal (Blue2)	34	VDD	Logic Power supply: +3.3V
7	B1P	RSDS data signal (Blue1)	35	VIN5	Power supply: +5V
8	B1N	RSDS data signal (Blue1)	36	VIN5	Power supply: +5V
9	B0P	RSDS data signal (Blue0)	37	VIN5	Power supply: +5V
10	B0N	RSDS data signal (Blue0)	38	STV	Scan driver start pulse
11	G2P	RSDS data signal (Green2)	39	CKV	Scan driver clock
12	G2N	RSDS data signal (Green2)	40	OE	Scan driver output enable
13	G1P	RSDS data signal (Green1)	41	NC	No connection
14	G1N	RSDS data signal (Green1)	42	NC	No connection
15	G0P	RSDS data signal (Green0)	43	GVOFF	3-level power control signal
16	G0N	RSDS data signal (Green0)	44	NC	No connection
17	CLKP	Data driver clock	45	GND	Ground
18	CLKN	Data driver clock			
19	R2P	RSDS data signal (Red2)			
20	R2N	RSDS data signal (Red2)			
21	R1P	RSDS data signal (Red1)			
22	R1N	RSDS data signal (Red1)			
23	R0P	RSDS data signal (Red0)			
24	R0N	RSDS data signal (Red0)			
25	GND	Ground			
26	NC	No connection			
27	NC	No connection			
28	STH	source driver start pulse			

Note (1) CN2 Connector Part No.: HIROSE FH12-45S-0.5SH(55) or equal.

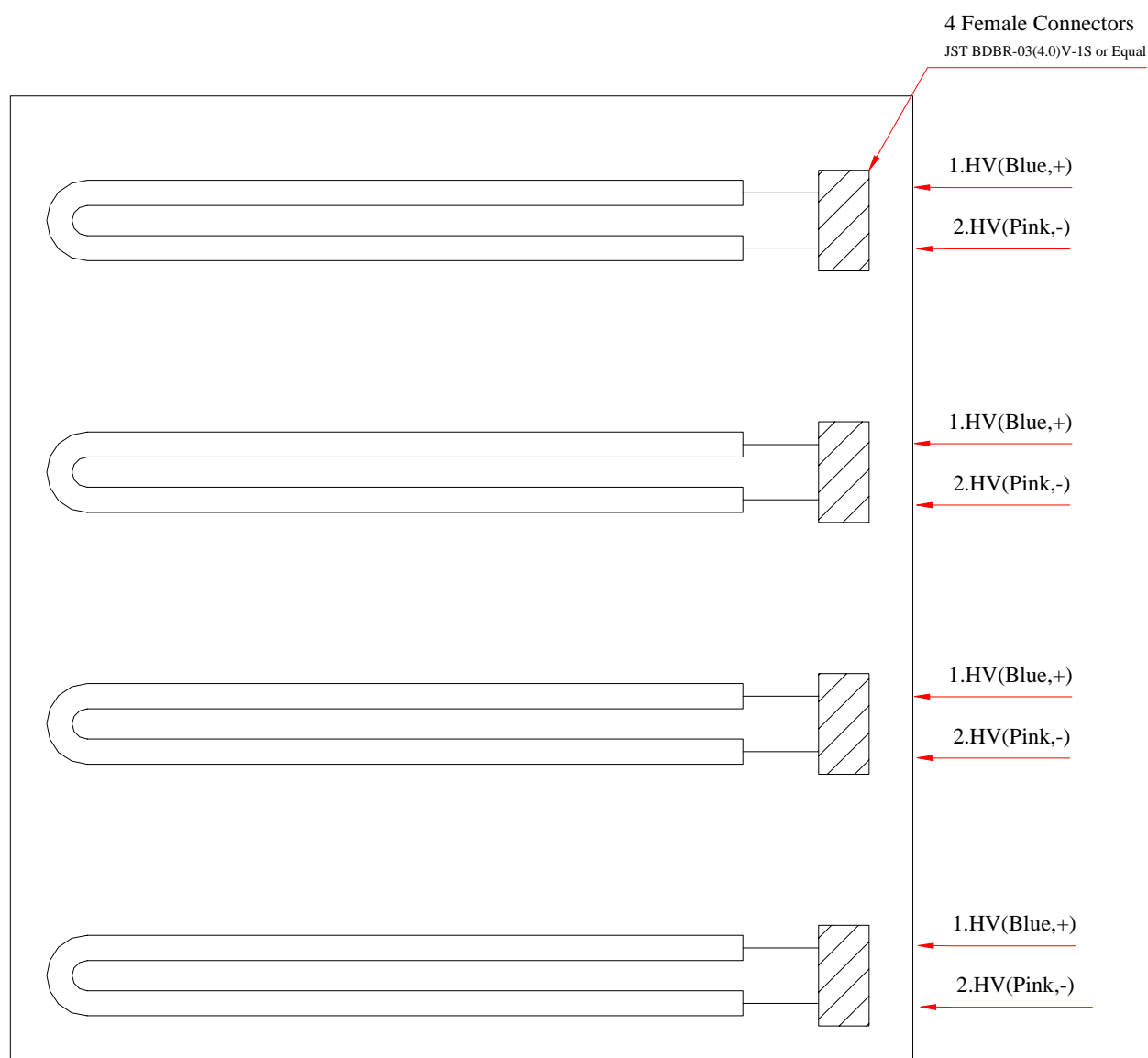
5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

CN3-CN6 (Housing): BDBR-03(4.0)V-1S(JST) or equivalent

Pin No.	Symbol	Description	Wire Color
1	HV	High Voltage	Blue
2	HV	High Voltage	Pink

Note (1) The backlight interface housing for high voltage side is a model BDBR-03(4.0)V-1S, manufactured by JST or equivalent.



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

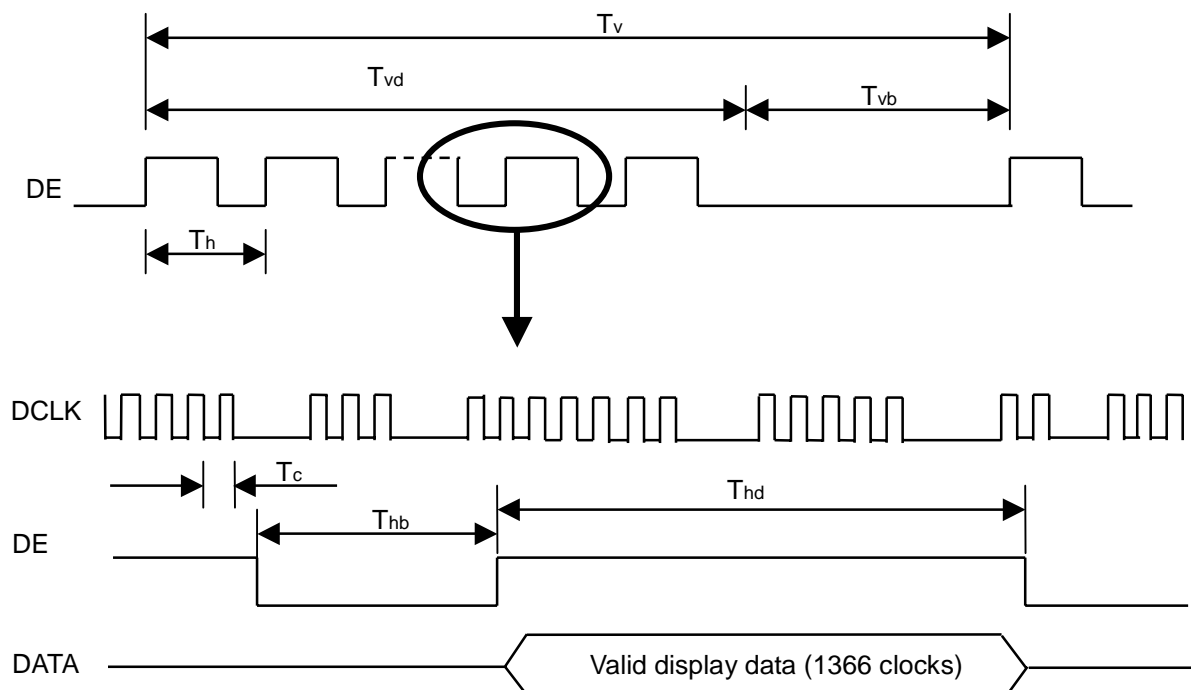
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

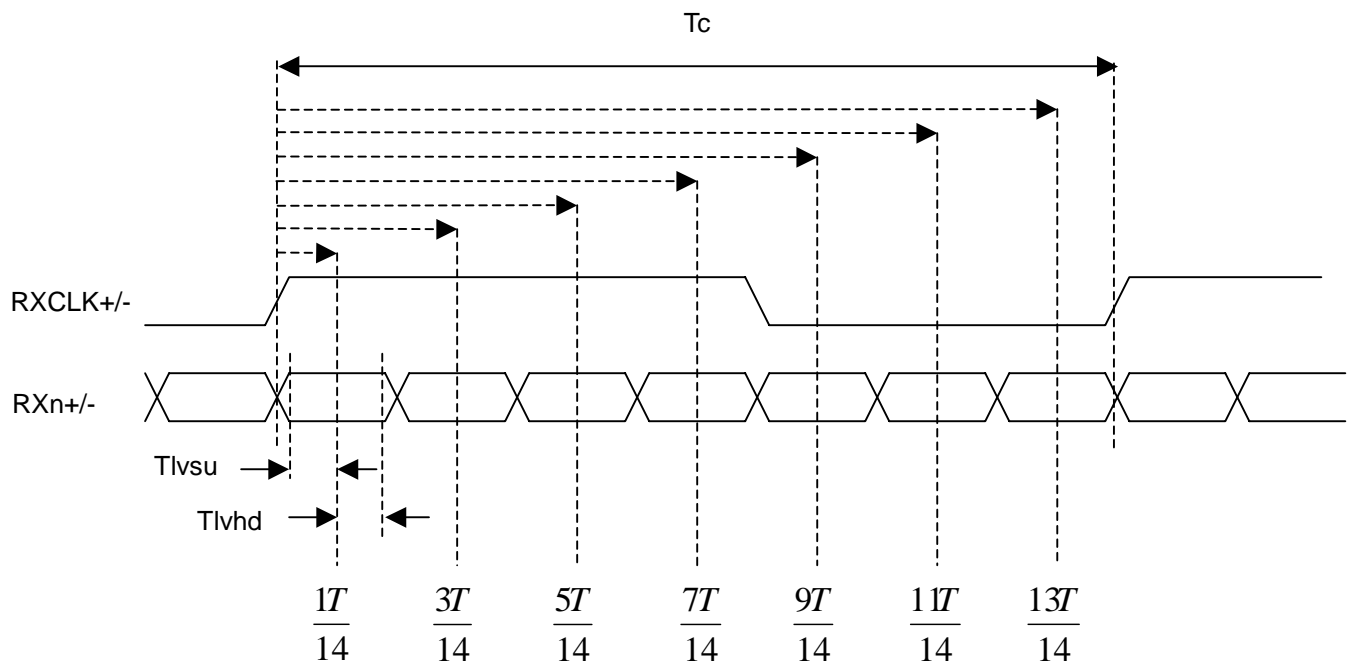
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	74	82	MHz	
	Input cycle to cycle jitter	Trcl	-	-	200	ps	
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	
	Hold Time	Tlvhd	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr5	47	50	53	Hz	
		Fr6	57	60	63	Hz	
	Total	Tv	778	795	888	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	10	27	120	Th	-
Horizontal Active Display Term	Total	Th	1442	1798	1936	Tc	Th=Thd+Thb
	Display	Thd	1366	1366	1366	Tc	-
	Blank	Thb	76	432	570	Tc	-

Note: Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

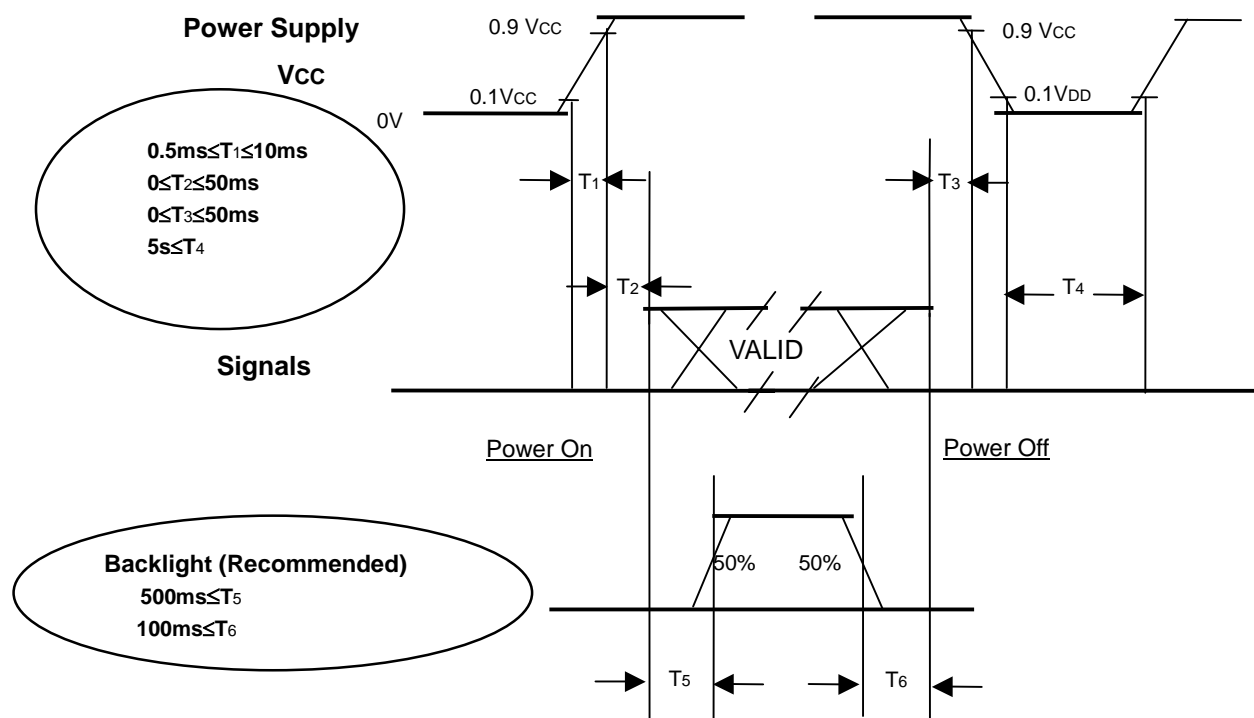


LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



Power ON/OFF Sequence

Note.

- (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2) Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.
- (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power on/off periods.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current (High side)	I _L	7.5mA ± 0.5	mA
Oscillating Frequency (Inverter)	F _W	58±3	KHz
Frame rate		60	Hz

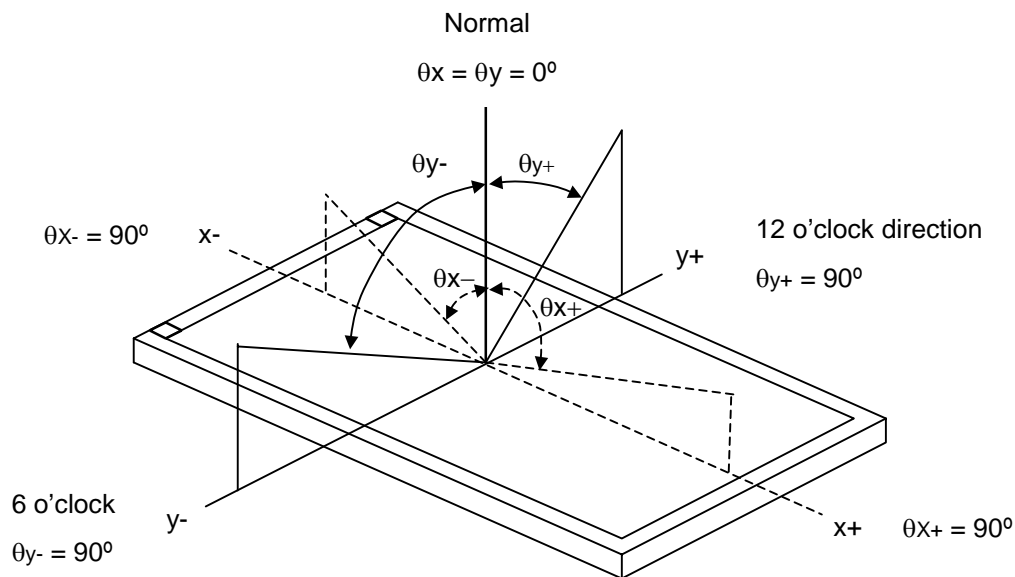
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note		
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle		(800)		-	(2)		
Response Time		T _R			(3)		ms	(3)		
		T _F			(5)					
Center Luminance of White		L _C			(400)			(4)		
White Variation		δW				(1.3)	-	(7)		
Cross Talk		CT				(4)	%	(5)		
Color Chromaticity	Red	R _x		Typ. -0.03	(0.637)	Typ. +0.03	-	(6)		
		R _y			(0.332)		-			
	Green	G _x			(0.268)		-			
		G _y			(0.590)		-			
	Blue	B _x			(0.150)		-			
		B _y			(0.059)		-			
	White	W _x			0.280		Target			
		W _y			0.285					
	Color Gamut				CG			(72)		%
	Viewing Angle	Horizontal	θ _{x+}		CR≥10			(80)		Deg.
θ _{x-}				(80)						
Vertical		θ _{y+}		(80)						
		θ _{y-}		(70)						

Note (1) Definition of Viewing Angle (θ_x , θ_y):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

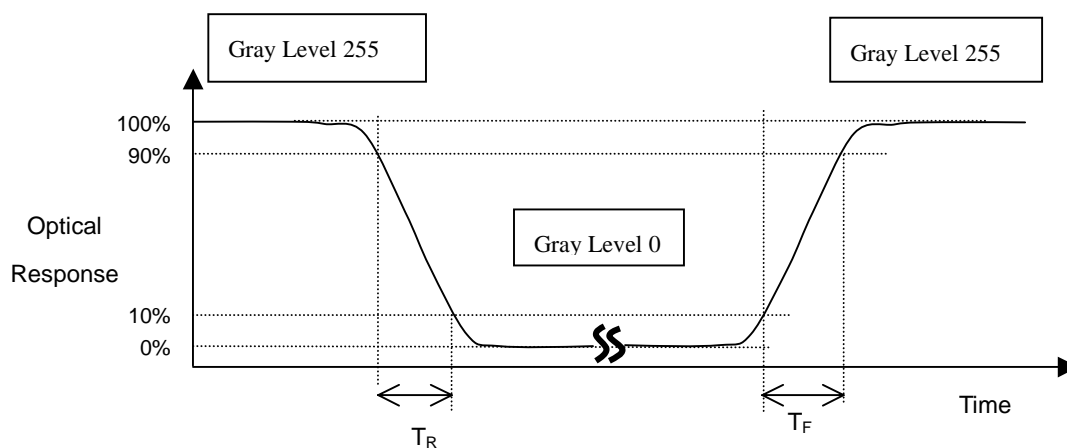
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 255 at center point and 5 points

$L_C = L(5)$, where $L(X)$ is corresponding to the luminance of the point X at the figure in Note (7).

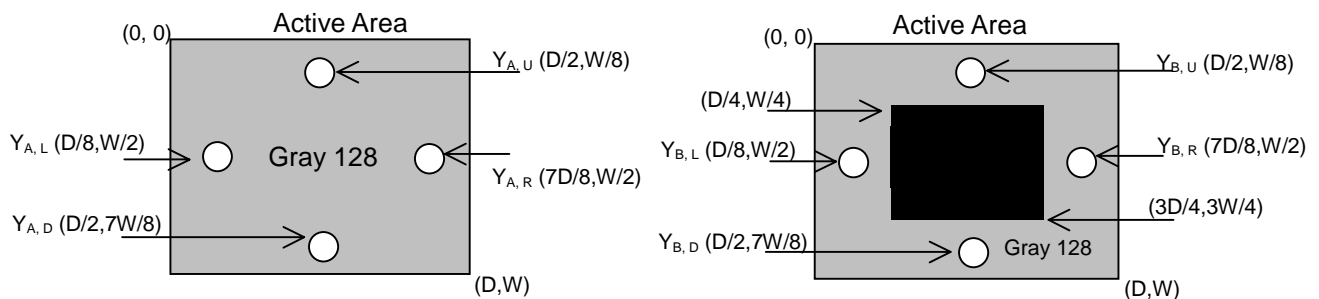
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

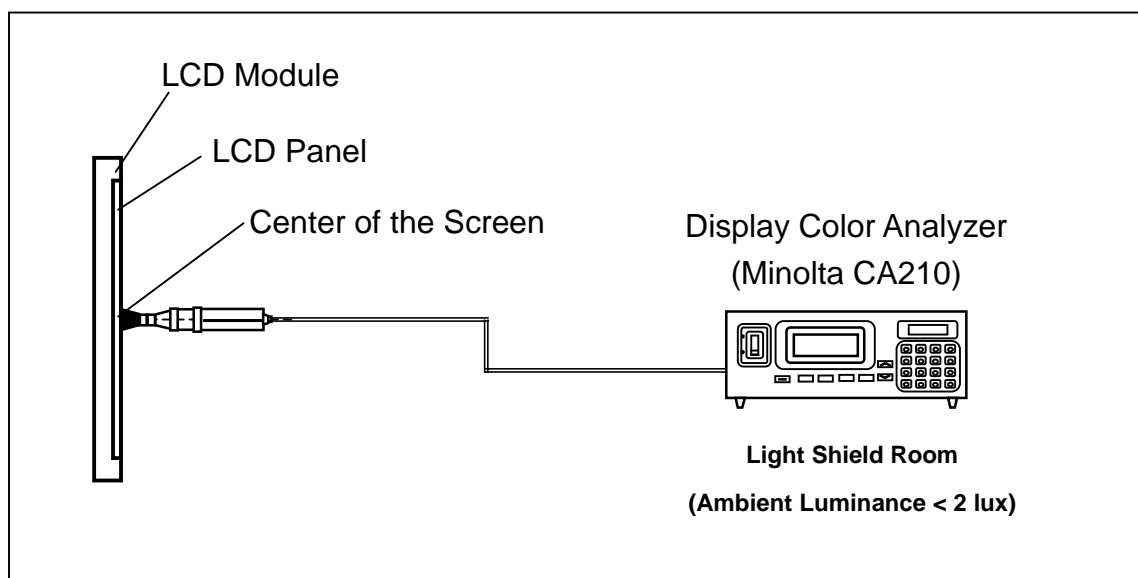
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

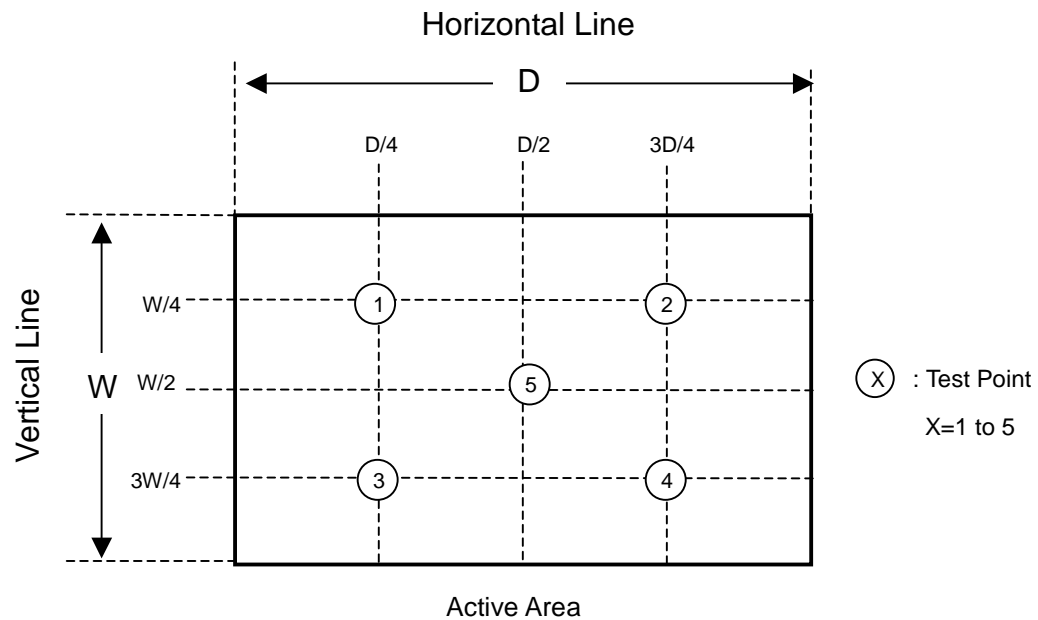
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum } [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum } [L(1), L(2), L(3), L(4), L(5)]$$



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

8.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

8.3 STORAGE PRECAUTIONS

When storing modules as spares for a long time, the following precaution is necessary.

- (1) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (2) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

9. REGULATORY STANDARDS

9.1 SAFETY

Regulatory	Item	Standard
Information Technology equipment	UL	UL 60950-1: 2003
	cUL	CAN/CSA C22.2 No.60950-1-03
	CB	IEC 60950-1:2001
Audio/Video Apparatus	UL	UL 60065: 2003
	cUL	CAN/CSA C22.2 No.60065-03
	CB	IEC 60065:2001

10. MECHANICAL CHARACTERISTICS

